Impact Evaluation of the Tanzania Water Sector Project

Baseline Results

DAR ES SALAAM, TANZANIA

JULY 24, 2014

SOCIAL IMPACT


Haba na haba
hujaza kibaba

MILLENNIUM CHALLENGE CORPORATION
UNITED STATES OF AMERICA

Tanzania Compact

<u>Compact 1</u>: 2008-2013, $698 million

<u>Goal</u>: advance economic growth and poverty reduction through strategic investments in transportation, energy, and water

<u>WSP</u>: $64.2 million
Lower Ruvu Plant Expansion, Dar es Salaam
Morogoro Water Supply Activity
Canceled: Non-revenue water component

Water Sector Project

Increase human and physical capital and reduce the prevalence of water-related diseases by expanding the capacity of the Lower Ruvu Water Treatment Plant from 180 to 270 million liters per day; rehabilitating water intake and water treatment plants, and improving the existing distribution network in the city of Morogoro.

Projected Long-Term Results
(Up to 20 years)

ESTIMATED BENEFICIARIES

2,801,856

ESTIMATED INCREASE IN HOUSEHOLD INCOME

$113,000,000

20-year projected benefits are based on the best, currently available, information and may be updated if new, more reliable, data becomes available.

Lower Ruvu
Dar es Salaam

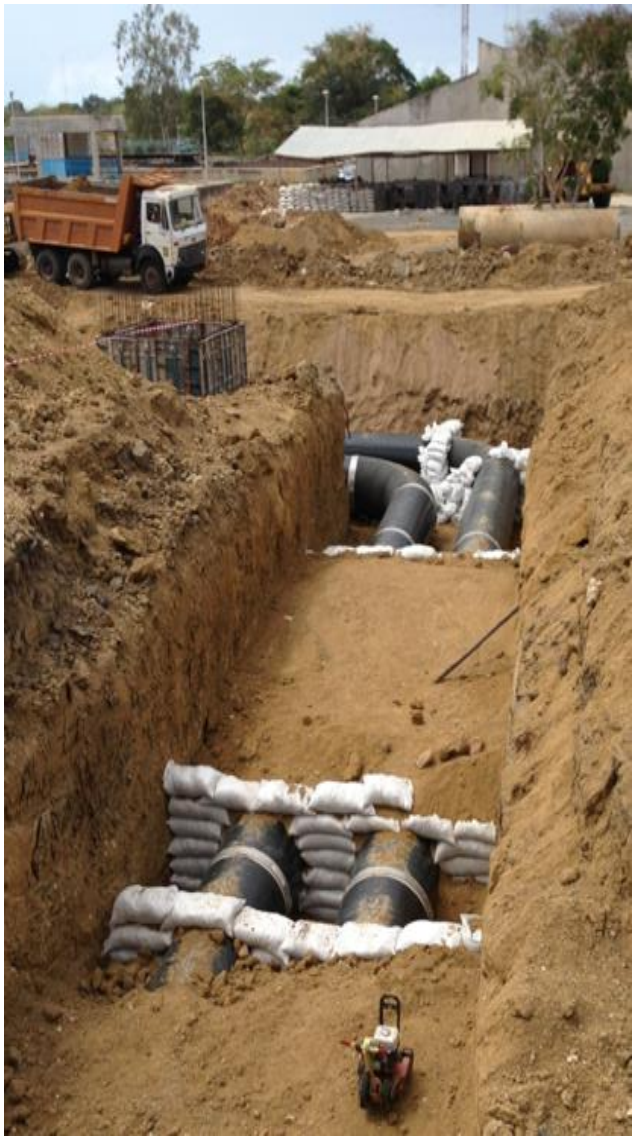
Mafiga & Mambogo
Morogoro

Evaluation Questions

Outcomes ***Impact on:***	**Objectives** ***Impact on:***	**Compact Goal** ***Impact on:***	**Implementation**	**Other Post-Intervention**
Water **supply** at the utility level **Demand** for connections to network **Access** to water and **availability** of water (household level) Water **quality** (source, distribution channel, point of consumption)	**Consumption** patterns of water at household level **Health** (diarrheal incidence among children under 5) **Investment** in physical and human capital **Sub-groups** including women, children, poor Businesses, schools, health centers	Poverty and income	**Implemented** according to plan? **Challenges** encountered? How were they addressed? **Lessons learned** from design and implementation? **Variations** in this activity worth considering in the future?	**Unintended results** of the project? Likelihood that results will be **sustained over time**? **Cost-effectiveness** or re-estimated Economic Rate of Return (ERR) based on realized benefits and costs of the project?

Impact Evaluation Design - Summary

- **Quasi-experimental design**: Tests cause and effect relationships, using statistical matching technique
- **Generalized Propensity Score Matching (GPSM)**: Statistically matches households based on similar characteristics (socioeconomic status, demographics, baseline water access and use), and compares outcomes between similar households
- **Mixed methods analysis:** Qualitative, geospatial, and direct measurement data supplement quantitative data from household questionnaire

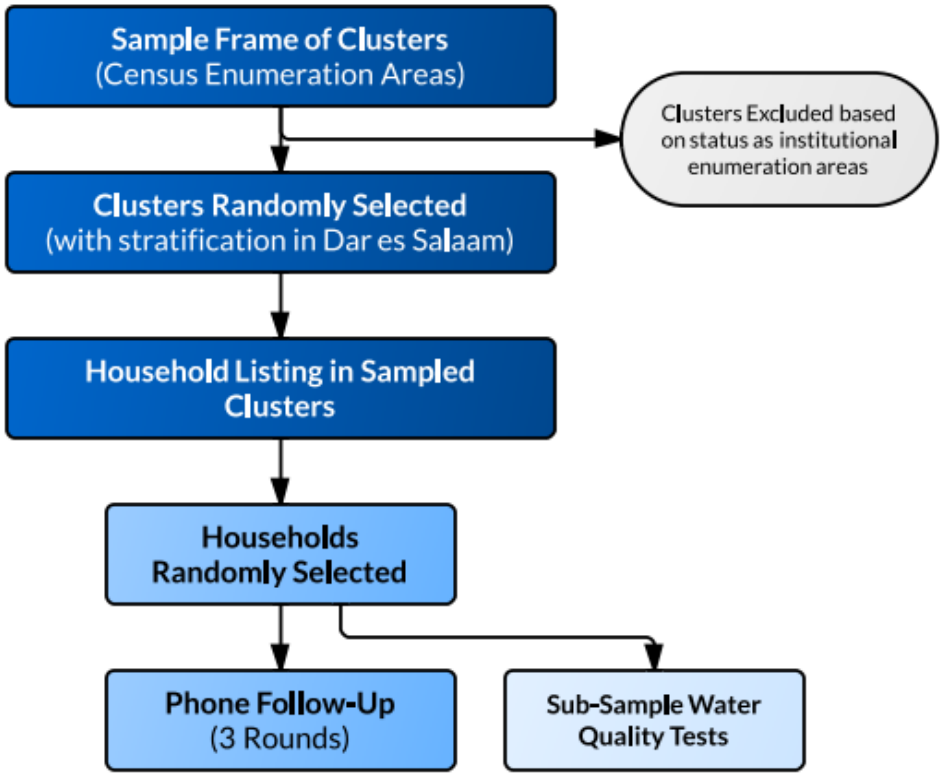


- **Primary and secondary data:** Analysis uses primary data collected in Dar es Salaam and Morogoro and secondary data from utilities and other agencies
- **Considers intervening factors**: Evaluates factors that may influence relationships between MCC interventions and outcomes of interest (e.g. water expenditures, water treatment practices)
- **Integrates process-related questions**: Examines how project implementation may influence project impacts

Data Collection

Listing: Mini-Survey
Mini-Survey
Listing: Full Baseline
Full Baseline Survey
Water Quality Tests
Phone Survey (3 rounds)
Qualitative Interviews
Geospatial & secondary data collection

April	May	Jun	Jul	Aug	Sept



Household sample size:
5,008 households surveyed from 626 census enumeration areas (clusters)

Electronic data collection by local firm, EDI, using Surveybe.

Dar es Salaam

313 clusters / 15,290
2% geographical coverage

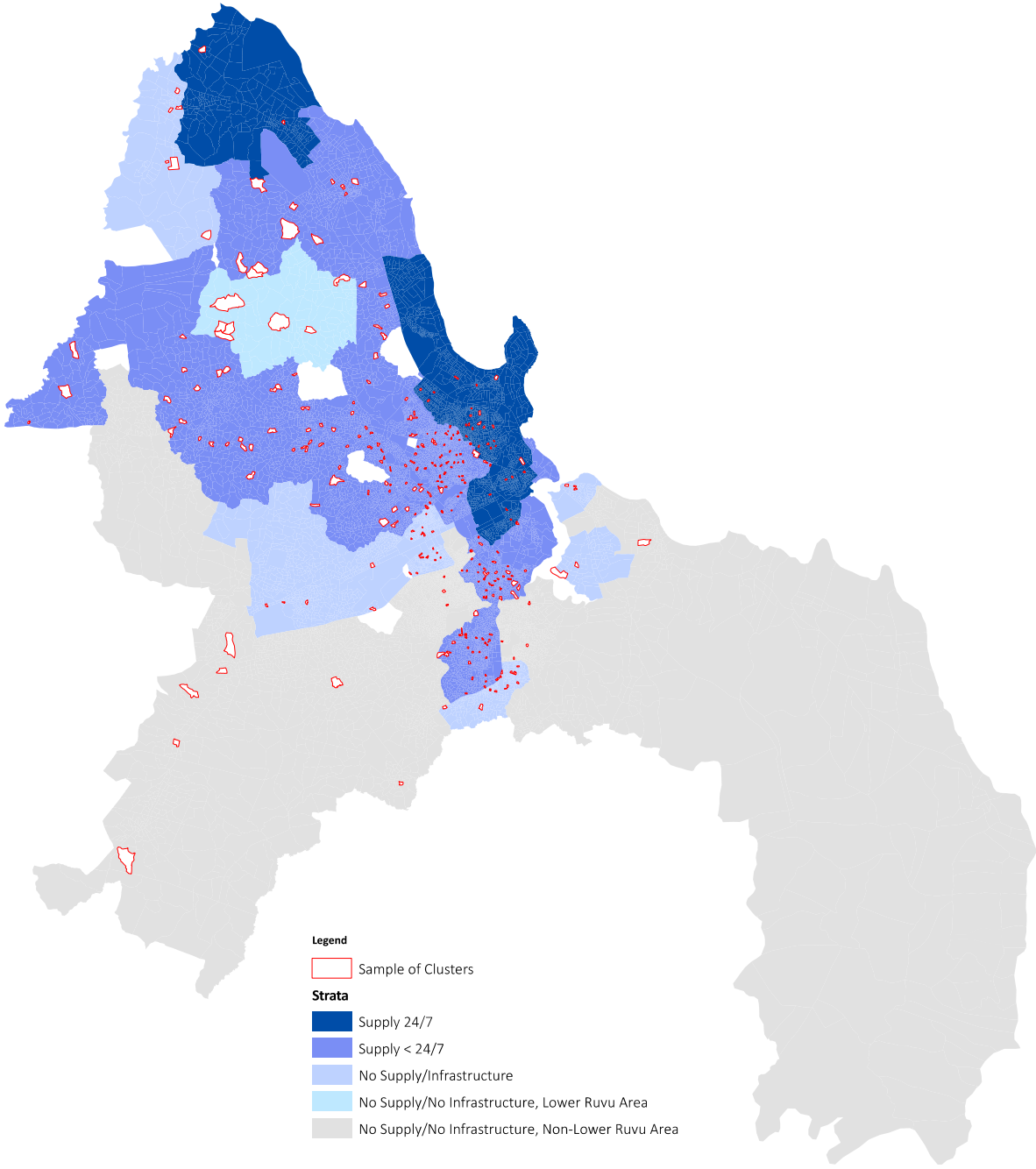
2,504 households interviewed
(8 households per cluster)

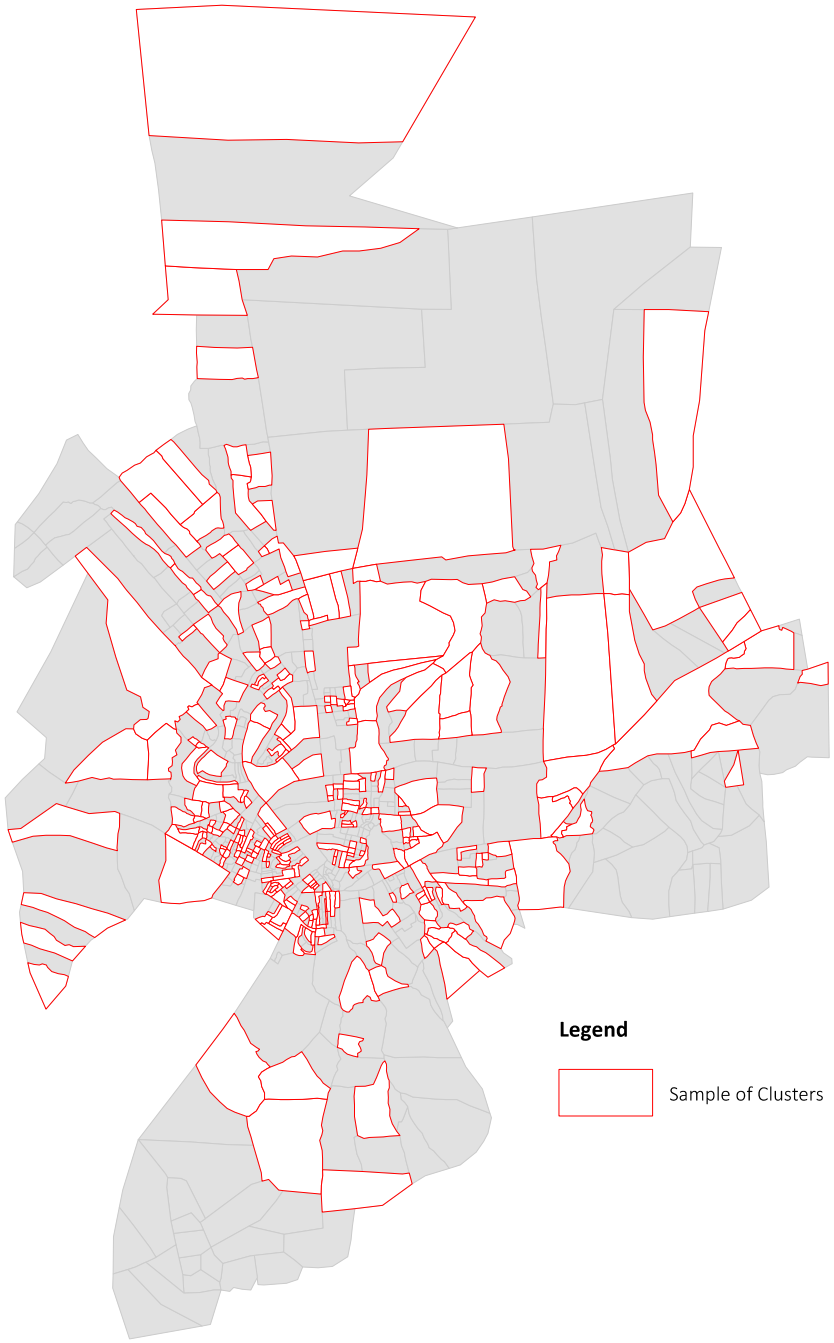
5 strata (DAWASCO data)
- No infrastructure (LR)
- No infrastructure (non LR)
- 0 hours, infrastructure
- Supply < 24/7
- Supply 24/7

97.3% of sample achieved in first attempt to contact

82% response rate overall
(88% & 75% in first & second attempts)

<1% refusal rate





Morogoro

313 clusters / 717
44% geographical coverage

2,504 households interviewed
(8 households per cluster)

99% of sample achieved in first attempt to contact

79% response rate overall
(93% & 65% in first & second attempts)

<1% refusal rate

Phone Surveys

Participation in all 3 rounds:

- 83% of households in Dar es Salaam
- 78% of households in Morogoro
- ~90% from both cities in 3rd round

Geospatial Data

- EA boundaries for sampling (NBS)
- Household GPS coordinates (EDI)
- Rainfall measurements (TMA)
- Distribution network (DAWASCO/MORUWASA)
- Updated network & kiosks in Morogoro (K. Serafin)

Water Quality Testing

- 515 tests in Dar es Salaam covering 302 clusters
  - 24% from household taps
- 598 tests in Morogoro covering 313 clusters
  - 83% from household taps

Qualitative Data

- 14 focus groups
- 52 interviews: water kiosks, tankers, vendors, businesses, community-managed sources
- 12 Health/Edu site visits
- 10 Key Informants interviews

Outcomes

Impact on:

Water supply at the utility level

Demand for connections to network

Access to water and availability of water (household level)

Water quality (source, distribution channel, point of consumption)

Water Supply: Utility-level

As of September 2013:

- Lower Ruvu intervention producing baseline supply
- Morogoro residents already receiving some increased supply as Mafiga producing almost at new capacity
- MORUWASA estimates 14 average service-hours per day for households in network, with 31% having 24/7 access (no data for Dar es Salaam)
- Consumption estimated by utilities at 70-100 L/capita/week
- Non-Revenue Water (NRW) in Dar es Salaam is >50%, Morogoro is <25%*
- Continuity of service in Morogoro:
  - 13-17 service hours/day, on average

    (varies by month)
  - 28-31% of customers have 24/7 access

Flow meter at Mafiga

Sources: DAWASA, MORUWASA reports to MCA-T and MORUWASA monthly reports

***NRW estimates for Morogoro are <25% through June 2013 in both MORUWASA monthly reports and MCA-T ITT (indicator tracking table) data. MCA-T ITT data for Q20 of the Compact (Jul-Sept 2013) have an estimate for NRW in Morogoro that has been revised upward, to approximately 46%.**

Water Supply: Utility-level

- Supply not meeting demand in either city
  - Monthly reports in Morogoro show that production is about two-thirds of estimated demand.
  - Increased supply through the system has potential to incite demand for connections.
  - *Potential demand* (estimated using census 2012 data)
    - Dar es Salaam: over 1 million households (compared to 202 thousand connected)
    - Morogoro: over 77 thousand households (compared to 23 thousand connected)
- Potential for impact:
  - Without even increasing the number of connections, there is potential for impact if non-active customers begin receiving water

Source: DAWASA, MORUWASA reports to MCA-T and MORUWASA monthly reports

Outcomes

Impact on:

Water supply at the utility level

Demand for connections to network

Access to water and availability of water (household level)

Water quality (source, distribution channel, point of consumption)

DAR ES SALAAM	Apr-June '13 Q19	July-Sept '13 Q20
Customers with connection to line but no water (zero meter reading): Lower Ruvu	66,338	66,204
Total number of customers: Lower Ruvu	201,991	201,681
Total number of current domestic customers: Lower Ruvu	**126,847**	**127,985**
Total number of current non-domestic customers: Lower Ruvu	**6,186**	**6,418**
Proportion of non-active customers: Lower Ruvu (%)	**33%**	**33%**

MOROGORO	Apr-June '13 Q19	July-Sept '13 Q20
Total number of current domestic customers	**22,608**	**22,802**
Total number of current non-domestic customers	**1,321**	**1,372**
Proportion of non-active customers (%)	**2%**	**6%**

Morogoro	February	March	April	May	June
Volume of water produced (m^3)	695,500	675,000	715,000	713,000	709,000
Estimated monthly demand (m^3)	1,104,320	1,222,640	1,183,200	1,222,640	1,183,000

Outcomes

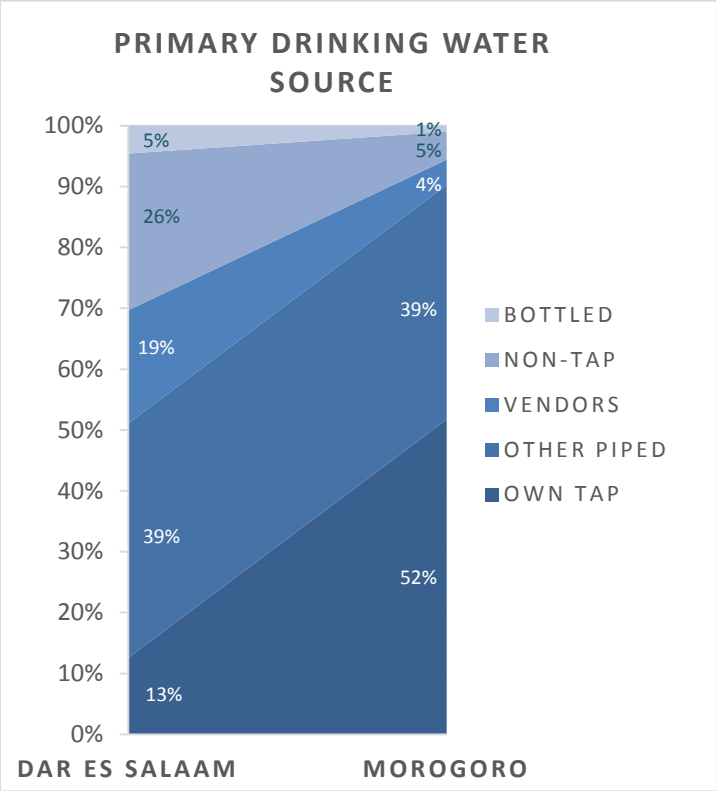
Impact on:

Water supply at the utility level

Demand for connections to network

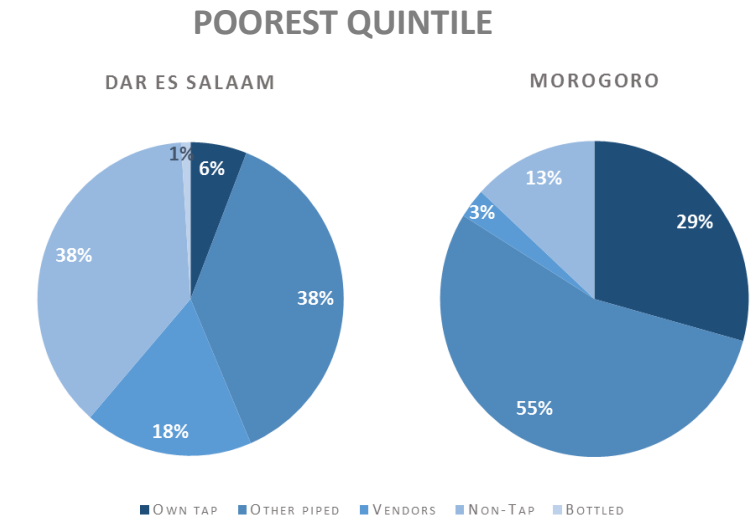
Access to water and availability of water (household level)

Water quality (source, distribution channel, point of consumption)



Households using, as primary source:

- Own tap on premises
  - 13% in Dar es Salaam
  - 52% in Morogoro
- Piped source (own tap, or other piped)
  - 52% of residents in Dar es Salaam
  - 91% in Morogoro



In Dar es Salaam, a fifth of the poorest households obtain drinking water primarily from vendors (3% in Morogoro).

~40% of the poorest in Dar es Salaam use a non-tap source for drinking.

Poor households are more likely rely on sources of lower quality & those that require more time and money (especially in Dar es Salaam).

Outcomes

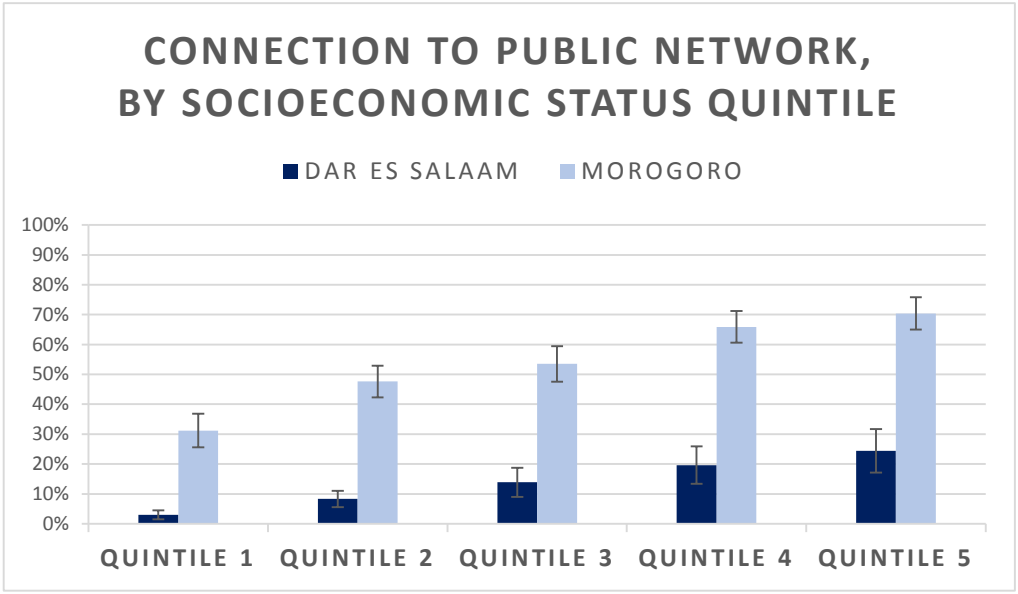
Impact on:

Water supply at the utility level

Demand for connections to network

Access to water and availability of water (household level)

Water quality (source, distribution channel, point of consumption)



But poorest may not necessarily benefit directly from the interventions.

The most immediate and direct benefits of the project are expected to go to those connected to the network.

Households of the lowest socioeconomic status have the lowest connection rates to public distribution network.

- Dar es Salaam: 3% of the poorest are connected to a public network tap, and 24% of the wealthiest.
- Morogoro: 31% of the poorest are connected, and 70% of the wealthiest.

Outcomes

Impact on:

Water supply at the utility level

Demand for connections to network

Access to water and availability of water (household level)

Water quality (source, distribution channel, point of consumption)

Water source use by activity

	Dar es Salaam			
Water Source	**Drinking**	**Cooking**	**Washing**	**Cleaning**
Own tap	15%	17%	17%	17%
Other piped	51%	52%	51%	51%
Vendors	29%	25%	24%	23%
Non-Tap	39%	57%	64%	65%
Bottled	12%	2%	1%	1%
Other	1%	1%	1%	1%
	Morogoro			
Water Source	**Drinking**	**Cooking**	**Washing**	**Cleaning**
Own tap	57%	58%	58%	58%
Other piped	52%	52%	51%	51%
Vendors	8%	8%	7%	7%
Non-Tap	25%	30%	36%	36%
Bottled	6%	0%	0%	0%
Other	2%	2%	2%	2%

In Dar es Salaam, non-tap sources are most frequently used for all activities other than drinking, followed by other piped sources.

In Morogoro, water from a tap on premises is most commonly used for all activities, with other piped sources next, and non-tap sources third.

- Reflects higher connection rates in Morogoro.

Since intervention aims to improve supply through the public network, changes in the overall portfolio and ranking of various sources will be assessed baseline to end-line.

Outcomes

Impact on:

Water supply at the utility level

Demand for connections to network

Access to water and availability of water (household level)

Water quality (source, distribution channel, point of consumption)

Statistical analysis modeling demand for piped water

1. Determinants of having a tap on premises
2. Determinants of choice of main source of drinking water

1. Determinants of having a piped source	2. Determinants of main drinking water source
Neighborhood effects are most influential: • Probability of having tap connection increases by 5.2% in Morogoro and 5.8% in Dar es Salaam, for each additional connected household in the neighborhood. • Household composition and housing characteristics not statistically significant factors when the neighborhood effects are considered. This suggests that use of piped water sources is mainly constrained by supply factors. Efforts to make piped water more available (e.g., through increased connection rates) likely to increase use substantially.	Socioeconomic status most influential: • Wealthiest >10% more likely to use tap compared to poorest • Households with best-educated adult completing primary school, are 36% less likely to use surface water Wealthier households more likely to benefit directly from an expansion in supply of tapped water through own tap; poorer households may benefit indirectly (at least at first).

Outcomes

Impact on:

Water supply at the utility level

Demand for connections to network

Access to water and availability of water (household level)

Water quality (source, distribution channel, point of consumption)

Qualitative Insights

- **Tap water is preferred** and sought out for drinking in both cities
- **Borehole/shallow well water** is much more abundant in Dar es Salaam, but due to its salinity, it cannot be used for all purposes, including consumption
- **Even those connected rely on other sources** due to irregular schedules and frequent rationing experienced through the network
- **Other sources each present distinct challenges** (collection times, mark-ups)
- **Mixed perceptions about public utility**: respondents believe utilities trying to serve the population well, but frustration about billing and erratic rationing persists

"If water increased… I would no longer have to buy water from wells. I spend [1200 TZS] every day on water, therefore if I pay DAWASCO bills the cost would be lower."

"…their water flows once a month; how can I wait for water that comes once a month or once in two months? … One asks, where do all these charges come from? … Even when you open the tap and only air comes out, it reads as if water was flowing."

Outcomes

Impact on:

Water supply at the utility level

Demand for connections to network

Access to water and availability of water (household level)

Water quality (source, distribution channel, point of consumption)

System-Level Water Quality

- CDC recommends minimum dosage of .5 mg/L of free chlorine to maintain the quality of water through a distribution network; lower levels are not considered sufficient to disinfect tap water.
- Dar es Salaam:
  - Lower Ruvu treatment plant: Only 1 of 4 water samples met CDC threshold.
  - Upper Ruvu treatment plant: All samples successfully met CDC criteria
  - Mtoni treatment plant: 3 of 4 met criteria
- Morogoro:
  - Mambogo: Almost all samples have insufficient chlorination. Treatment plant still under construction without full treatment capabilities yet.
  - Mafiga: Almost all samples (7 of 8) met CDC threshold.

Chlorine dosing at Mafiga, in Morogoro

Improvements in the water treatment capability (especially in Morogoro) are likely to provide benefits of improved water quality to city residents.

Outcomes

Impact on:

Water supply at the utility level

Demand for connections to network

Access to water and availability of water (household level)

Water quality (source, distribution channel, point of consumption)

Household water quality

Water quality tests included fecal bacteria (coliform microbial density), total chlorine (sub-sample free chlorine), and turbidity.

Fecal Bacteria

	Dar es Salaam			Morogoro		
Fecal bacteria risk rating	**Household**	**Community**	**Overall**	**Household**	**Community**	**Overall**
Satisfactory	90 73%	254 65%	344 67%	378 77%	50 48%	428 72%
Unsatisfactory	34 27%	137 35%	171 33%	116 23%	54 52%	170 28%
Total	**124** 100%	**391** 100%	**515** 100%	**494** 100%	**104** 100%	**598** 100%

- At households, 1/4th of samples contaminated with fecal bacteria
- At community/shared tap sources quality was worse and much more varied
- Areas closer to the distribution network less likely to have poor water quality: greater access to the piped network appears to yield safer water
- Project improvements may benefit households using poorer quality sources if they can switch to piped sources

Water from community source in Morogoro

Outcomes

Impact on:

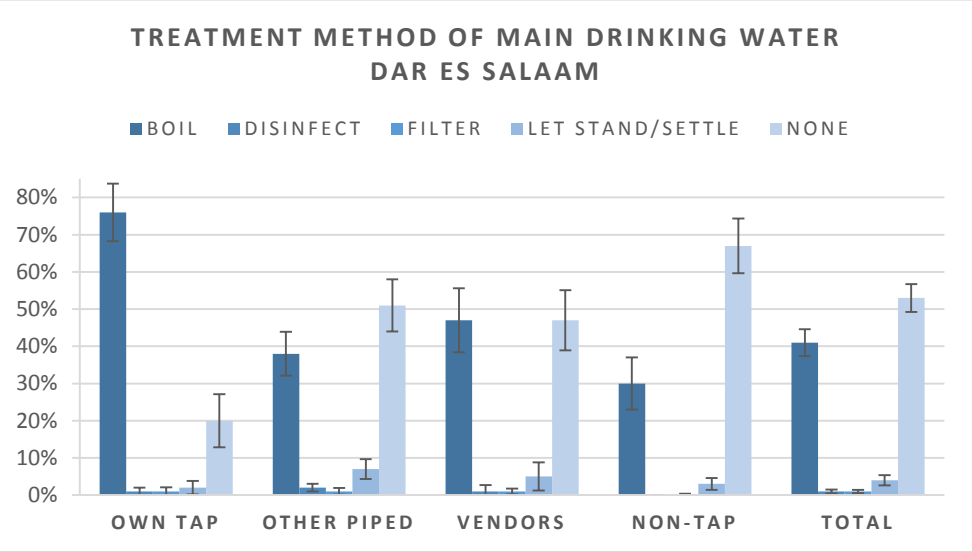
Water supply at the utility level

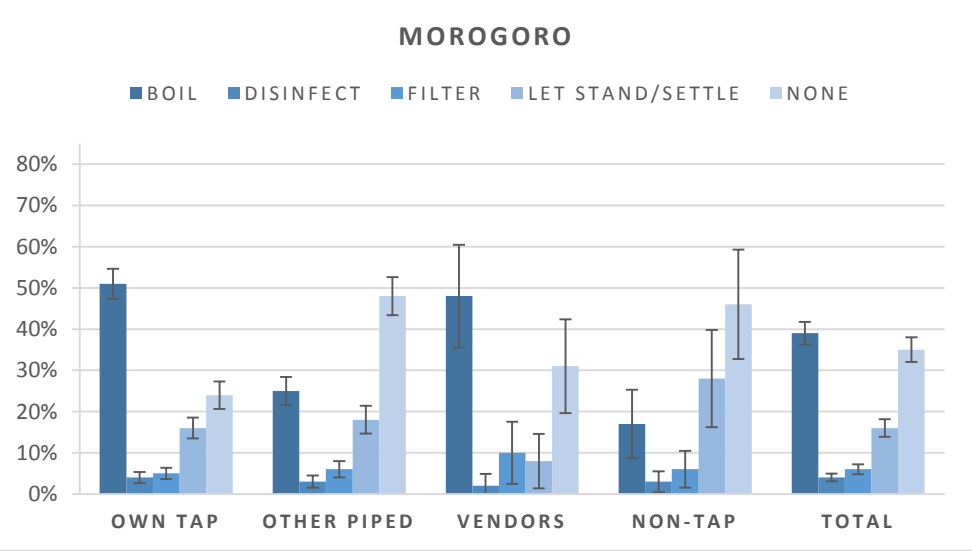
Demand for connections to network

Access to water and availability of water (household level)

Water quality (source, distribution channel, point of consumption)

Intervening factor: water treatment





- Tap water most likely to be treated
- Non-tap water is the least likely (with the exception of water from vendors in Morogoro)
- Many respondents do nothing to treat water, especially from non-tap sources

Statistical model results:

- Access to piped water increases probability of treating water by 11%
- Increased education of best-educated adult and higher SES also positively associated with water treatment

Objectives

Impact on:

Consumption patterns of water at household level

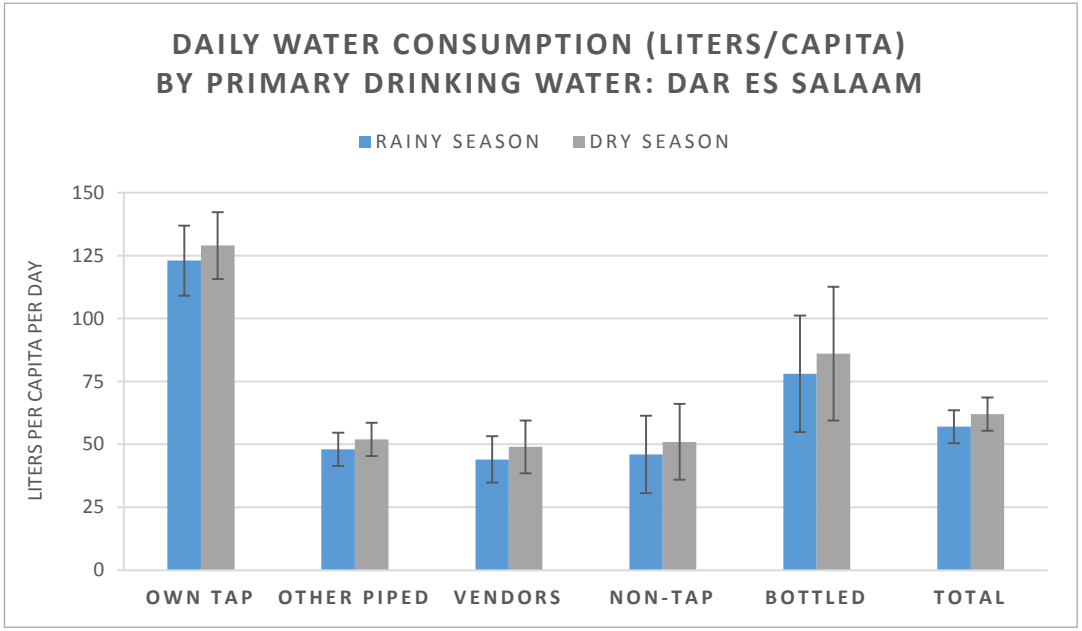
Health (diarrheal incidence among children under 5)

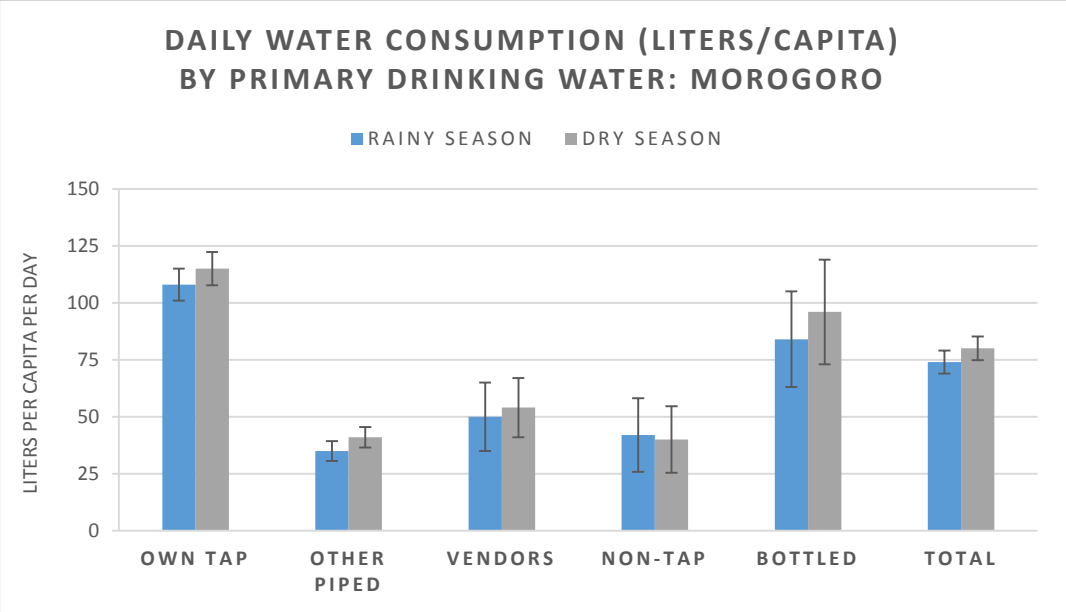
Investment in physical and human capital

Sub-groups including women, children, poor

Businesses, schools, health centers

Water consumption (daily liters per capita)





- Households using own tap and bottled water for drinking consume more water/capita/day than those relying on other sources
- Average consumption estimates are below utility estimates (but piped water estimates similar to utility estimates)
- Wealthier households consume more water per capita, consistent with expectations, in both cities

Objectives

Impact on:

Consumption patterns of water at household level?

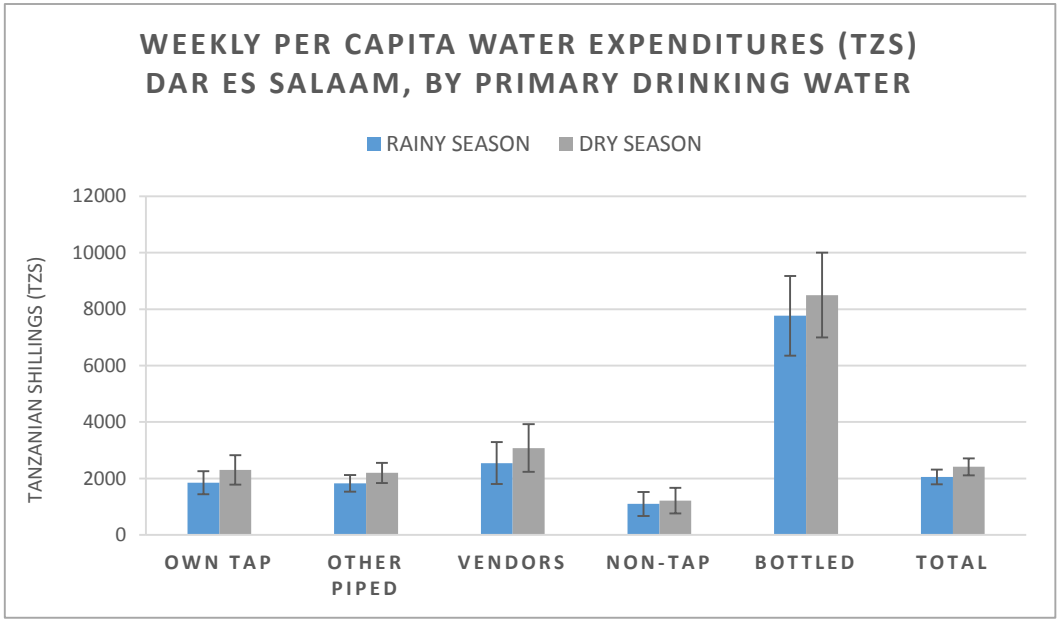
Health (diarrheal incidence among children under 5)

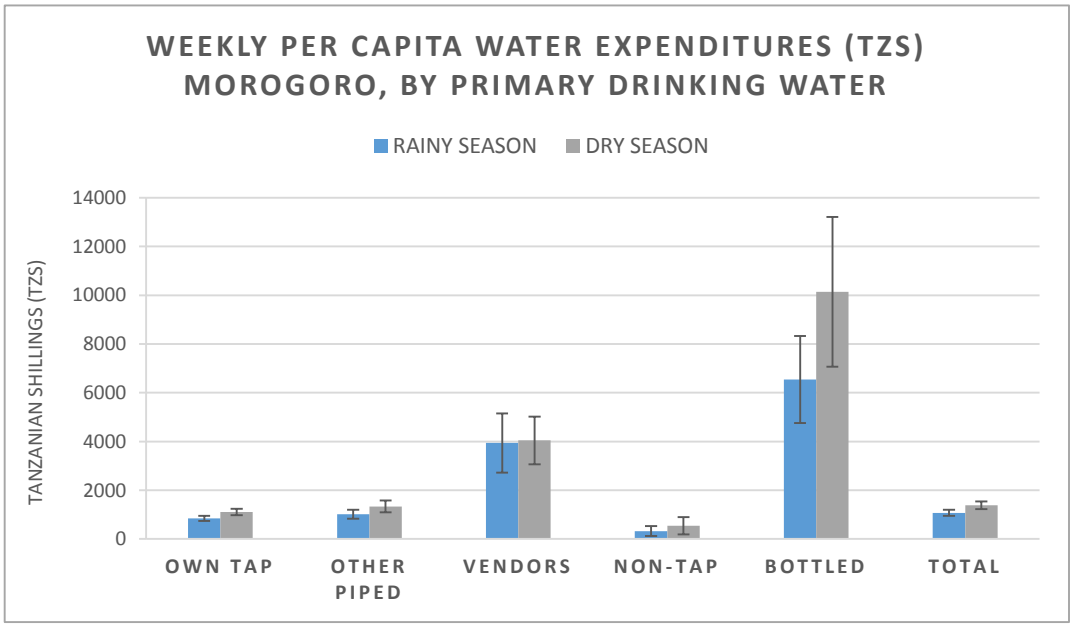
Investment in physical and human capital

Sub-groups including women, children, poor

Businesses, schools, health centers

Water expenditures (TZ Shillings per capita per week)





- Expenditures easier to measure from tap sources (from utility bills)
- Those using vendors pay higher prices relative to others, especially in Morogoro
- Seasonal differences are relatively minor, although expenditures slightly higher in dry season
- Daily water expenditures/capita increase with wealth
- Expenditures much higher in general in Dar es Salaam
- Expenditures higher in dry season

Objectives

Impact on:

Consumption patterns of water at household level?

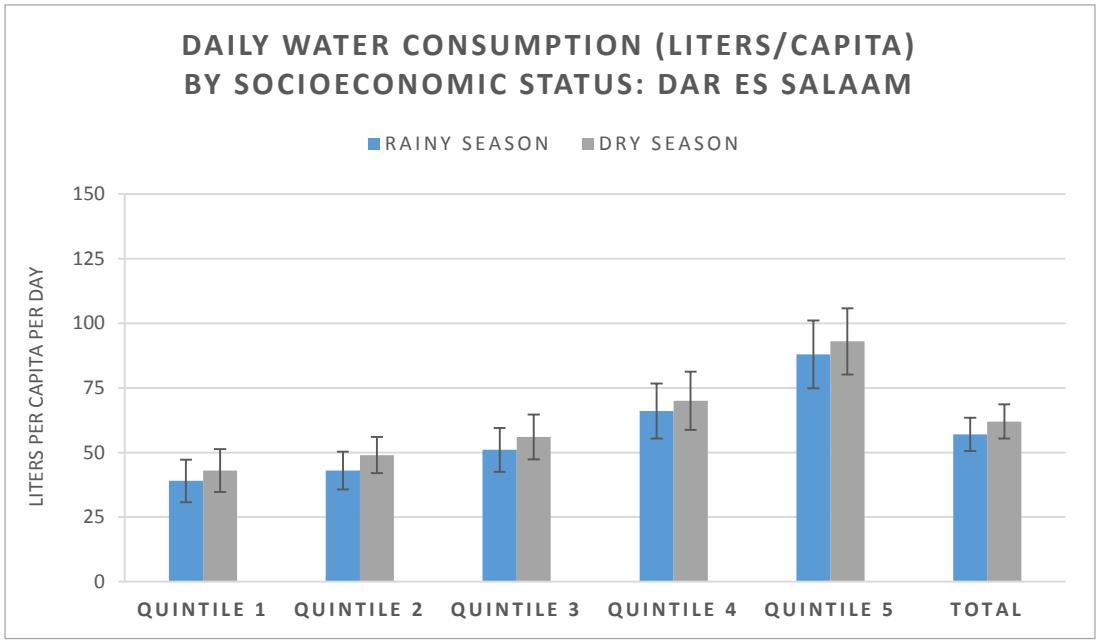
Health (diarrheal incidence among children under 5)

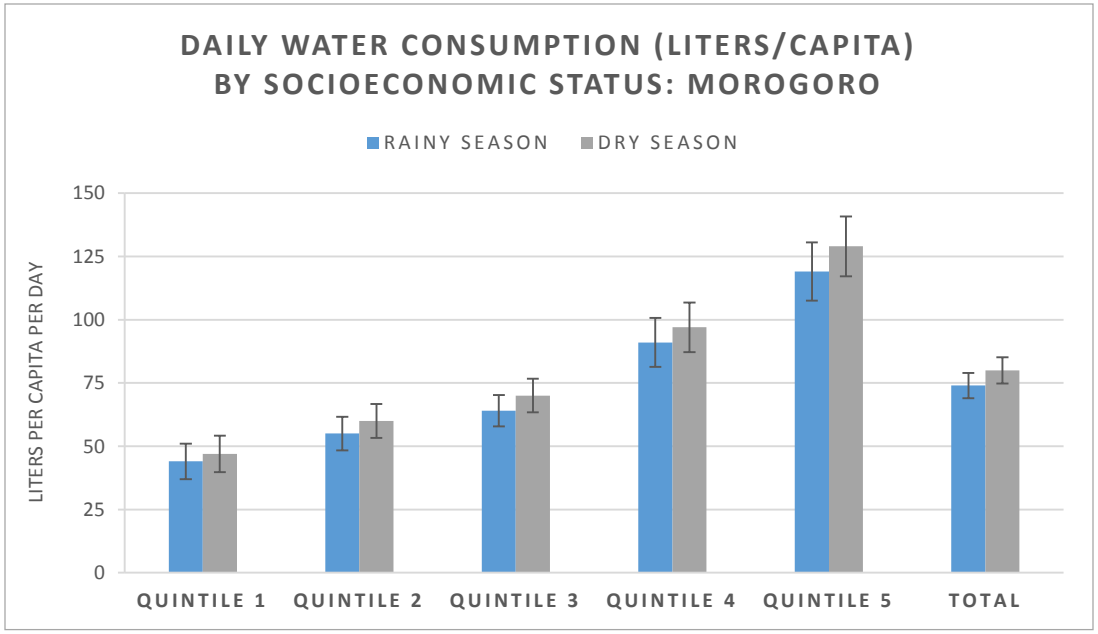
Investment in physical and human capital

Sub-groups including women, children, poor

Businesses, schools, health centers

Water consumption (daily liters per capita)





- Wealthier households consume more water per capita, consistent with expectations, in both cities

Objectives

Impact on:

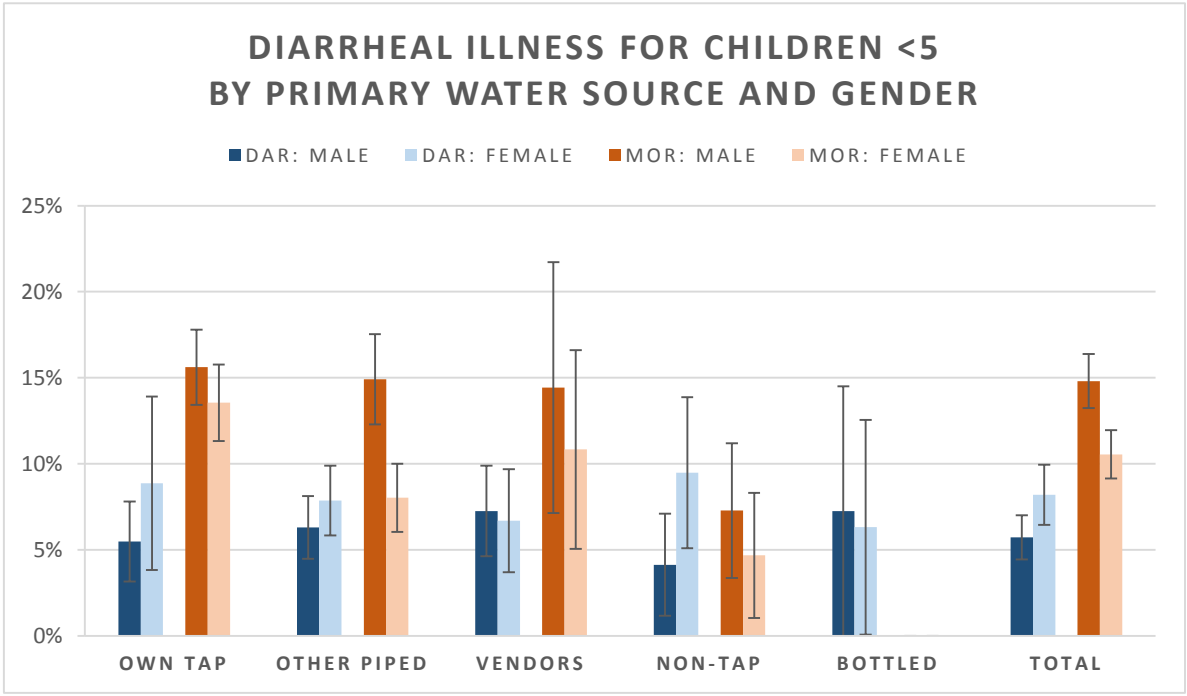
Consumption patterns of water at household level

Health (diarrheal incidence among children under 5)

Investment in physical and human capital

Sub-groups including women, children, poor

Businesses, schools, health centers



No clear findings with regard to diarrheal illness among children under 5 (Note: estimates are very imprecise)

- Few differences observed by water source
- Rates of illness for children in Morogoro higher for all sources
- Prevalence of diarrhea low overall, reducing precision

Objectives

Impact on:

Consumption patterns of water at household level

Health (diarrheal incidence among children under 5)

Investment in physical and human capital

Sub-groups including women, children, poor

Businesses, schools, health centers

Qualitative Insights

- Diarrhea represents only one type of illness. Typhoid, schistosomiasis, cholera, fungus, ringworm, rashes and itchiness, and urinary tract infections (UTIs) often cited.
- Water treatment behavior highly variable. Those using piped water tend to treat drinking water more regularly.
- Water salinity, makes water unsuitable for drinking, is an often cited problem with water quality.
- Contamination during storage or retrieval (e.g., tanks), and poor sanitation conditions due to a lack of clean water, rather than water quality itself, are respondent concerns.
- Women still bear the largest burden of water collection, including erratic supply hours, negotiating household budget, and risks to personal safety.
- Children are directly affected by scarcity, often enlisted to help collect water, and required to bring water to school in many areas. Water collection duties did not appear to keep children from attending school.

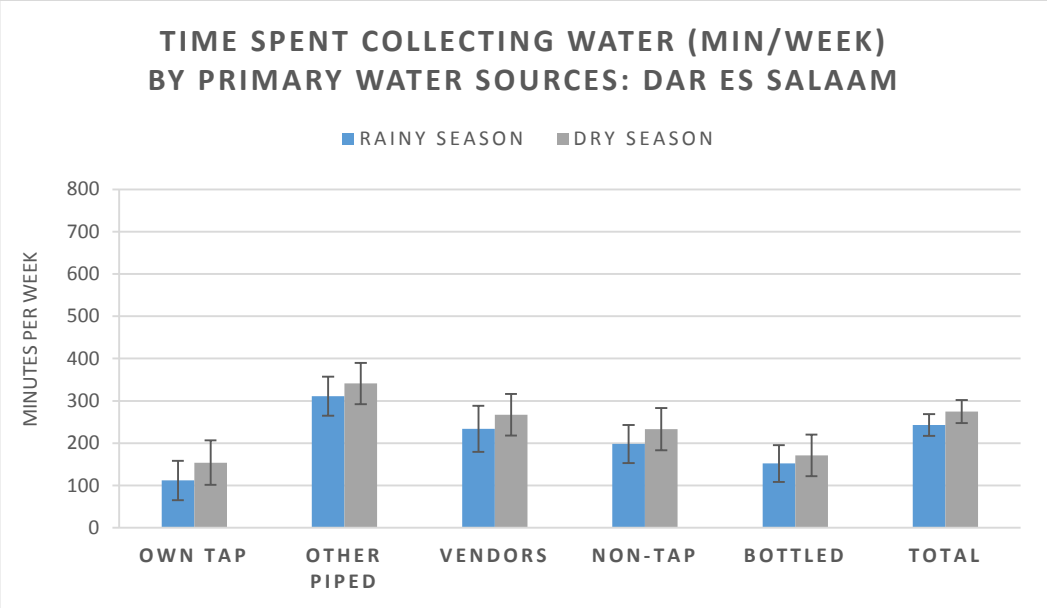
"Most parents are now very keen on school matters. If they [children] need to fetch water it is done after school. Not in the morning as many parents are now enlightened about education matters."

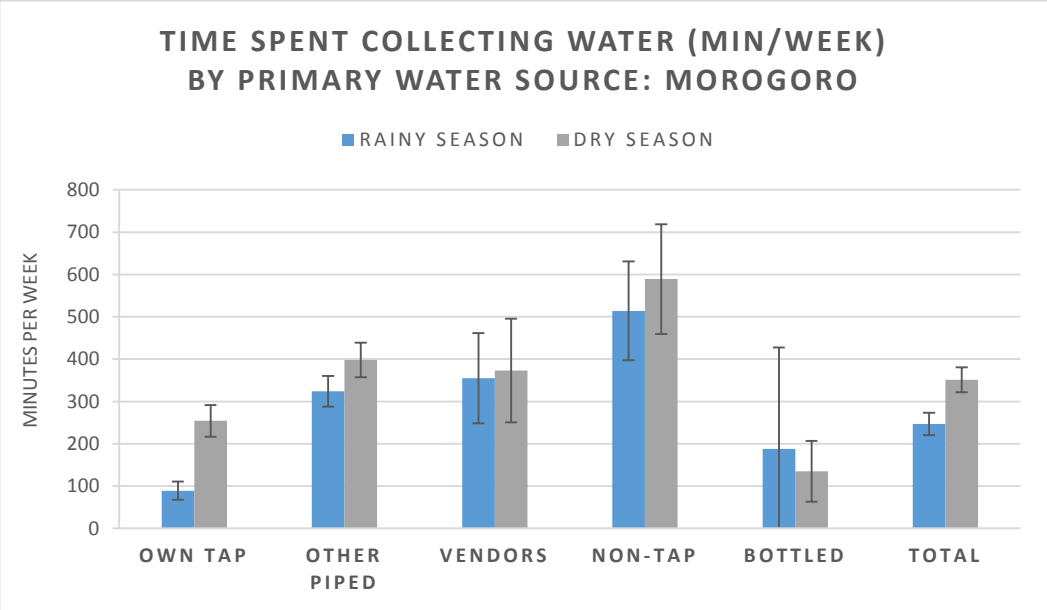
"Stomach fever, typhoid, diarrhea, sometime[s] you just become familiar so when you see the symptoms you just buy ciproflaxin and take it for three days rather than going for the checkup which cost[s] 5000 shillings."

"During the dry season the situation is … overwhelming because mothers endanger their lives as we have said earlier, we normally go to find water in other side of the road which may result in accidents from bicycles, motorcycles and even cars. In recent days they are about three or four who have encountered accidents due to this water problem so we are [scared]."

- **Objectives**
- ***Impact on:***
- Consumption patterns of water at household level
- Health (diarrheal incidence among children under 5)
- **Investment in physical and human capital**
- Sub-groups including women, children, poor
- Businesses, schools, health centers

Time spent collecting water





Households with own tap spend less time collecting water.

Differences in collection times greater in Morogoro (but estimates less precise).

Seasonal differences: longer collection times in dry season (as expected).

Socioeconomic differences not very pronounced; although wealthiest spend considerably less time hauling water

Objectives

Impact on:

Consumption patterns of water at household level?

Health (diarrheal incidence among children under 5)?

Investment in physical and human capital?

Sub-groups including women, children, poor?

Businesses, schools, health centers?

Health facilities

- **Scarcity threatens quality service provision**. Lack of consistent supply of clean water makes it difficult to perform essential tasks (surgery, sterilizing equipment, washing soiled linens, flushing toilets, and ensuring patients are properly bathed)
- **Health facilities use supplementary water sources** like boreholes, tanker-trucks, and storage reserves to mitigate against water shortages
- **Patients often bring their own water** to facilities

Objectives

Impact on:

Consumption patterns of water at household level

Health (diarrheal incidence among children under 5)

Investment in physical and human capital

Sub-groups including women, children, poor

Businesses, schools, health centers

Schools

- **Water scarcity puts substantial pressure on limited public resources**. Schools reported using a mixed portfolio of piped water, boreholes, rainwater, and water tankers
- **Students are regularly affected** because of poor sanitary conditions, inducing some absenteeism among female students, inattention during lessons, inadequate meals. Students are often at risk of road accidents or missing lessons if collecting water during the school day
- **Water scarcity at home can impact absenteeism**, due to rationing (for washing or bathing), rather than water collection (as hypothesized)

Objectives

Impact on:

Consumption patterns of water at household level

Health (diarrheal incidence among children under 5)

Investment in physical and human capital

Sub-groups including women, children, poor

Businesses, schools, health centers

Vendors

- Water vendors of all types cited frequent unplanned rationing, or deviations from the expected timetable, as a consistent frustration with respect to carrying out their businesses. Due to the variability, some vendors sell water from multiple sources.
- Water tanker operators spend many hours queuing waiting to fill up tanks or drums; customer volume/day is thus low (e.g., 3-4/day).
- Water kiosk operators can be as dependent as households on rationing schedules and cannot do business when water doesn't flow.
- Push-cart operators face risk of accidents with vehicles in the road.

Objectives

Impact on:

Consumption patterns of water at household level

Health (diarrheal incidence among children under 5)

Investment in physical and human capital

Sub-groups including women, children, poor

Businesses, schools, health centers

Vendors

- Despite improvements to the water supply, residents likely to continue to rely on vendors, in light of the low connection rates and growing population.
- Vendors are hopeful about potential for supply improvements. While some expressed reservations about the completion of the project, most said if piped water supply became reliable, ultimately this would be have positive effects.

"If there is this possibility of bringing water such people, if he can get clean safe water close to him, to be honest to me it will not be a problem at all, I will find another means of getting money instead of water…"

"That will be good, we can't say don't add water because we need customers, if water flows in large volume that will be good for the users."

Implemented according to plan?

Challenges encountered? How were they addressed?

Lessons learned from design and implementation?

Variations in this activity worth considering in the future?

Implementation and Next Steps

- End-line data collection
  - Timing not yet determined due to delays in implementation
- Challenges:
  - ***Project Design:*** Designs thought to be "shovel-ready" required considerable additional preparation. Designs for most plant upgrades were reworked through new design contracts.
  - ***Transmission Main:*** After inspection of the existing pipe, engineers concluded existing pipe infrastructure could not support the doubling of supply. New transmission main construction ongoing.
  - ***Non-Revenue Water (NRW):*** Originally, MCC was to implement NRW reduction activity in Dar es Salaam to curb water produced but unbilled. This was eliminated due to redundancies with other programs. Key informants were not optimistic that full impacts of the investments can be realized without addressing NRW and weaknesses in the distribution network infrastructure.

Asanteni sana

Appendix

WATER SECTOR PROJECT LOGIC

Lower Ruvu Plant Expansion and Morogoro Water Supply

PROCESS		OUTPUTS		OUTCOMES		SHORT-TERM OBJECTIVES		MEDIUM-TERM OBJECTIVES		COMPACT GOAL	
Activities	Indicators	Result	Indicators	Result	Indicators	Result	Indicators	Result	Indicators	Result	Indicators
Finance feasibility, design activities	**Value of feasibility/design contract ($)***	Improve treatment plants	**Schedule of Performance Ratio (ratio)**	Improve water service coverage	**Number of non-domestic customers (#)***	Decrease incidence of water-borne related morbidity	Percentage of population with diarrhea in the last 2 weeks (%)	Decrease in mortality	National level <5 mortality rate (per 1000 births)	Poverty Reduction and Economic Growth	Average annual household income per capita ($)
	Value of feasibility/design contract disbursed ($)*	Increase water production	**Volume of water produced (liters/capita/day)***		**Number of domestic customers (#)***				National level Adult mortality rate (per 1000)		
	Certificate for Environmental Impact Assessment (EIA) issued (Date)	Reduce water losses	**Non-revenue water (%)***		**Percentage of non-active customers to total customers (%)**						
Finance construction activities	**Value of construction contract ($)***	Improve financial sustainability	**Operating Cost Coverage (ratio)***		Percentage of households with access to improved water supply (%)	Improve human capital accumulation	Average hours worked last week (hours)	Increase investment and economic activities	Average current value of household assets per capita ($)		
	Value of construction contract disbursed ($)*			Improve quality of service	**Continuity of service (hours/day)***		Percentage of school children who missed any in the last 4 weeks (%)				
				Improve quality of water	**Nephelometric turbidity units (NTU)**						
					Coliform Microbial Density (per 100 milliliters)						
					Free Chlorine Residual (FRC)						
		Increase temporary employment	**Total number of people temporarily employed/contracted by MCA-IEs (#)***	Increase water consumption	**Volume of commercial water consumption (cubic meters per month)***		Average time spent fetching water from home in last week (min)		Average value of commercial assets ($)		
					Volume of residential water consumption (liters/capita/day)*						

Bolded text refers to Indicator Tracking Table (ITT) Indicators which will be reported on a *quarterly* basis. All other indicators will be reported on as data is available.

* Refers to Millennium Challenge Corporation Common Indicators for the Water Sector

Outcomes

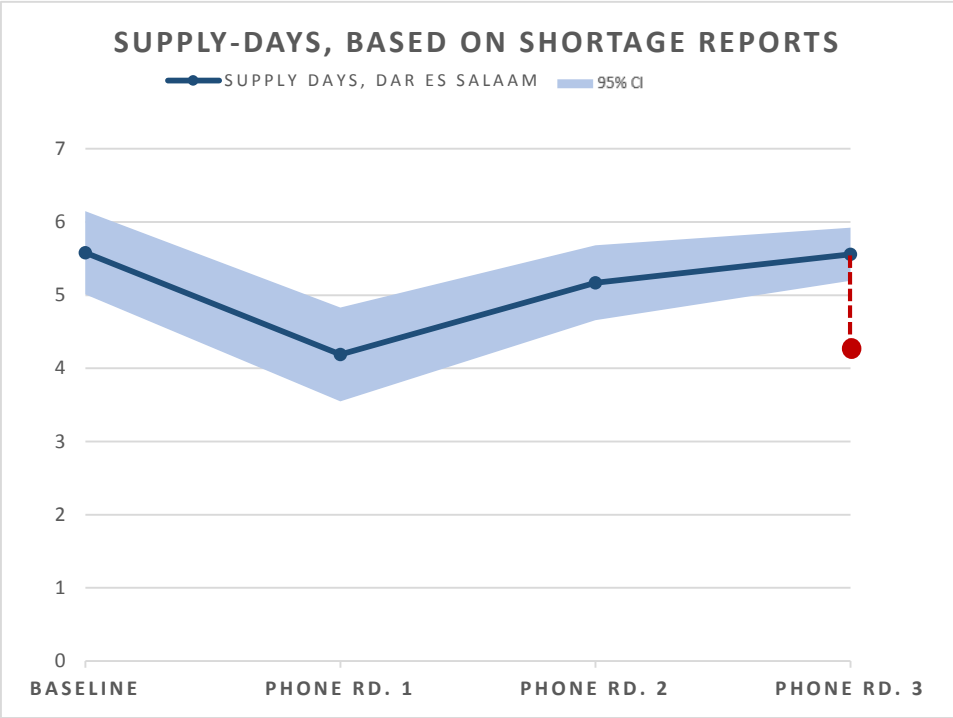
Impact on:

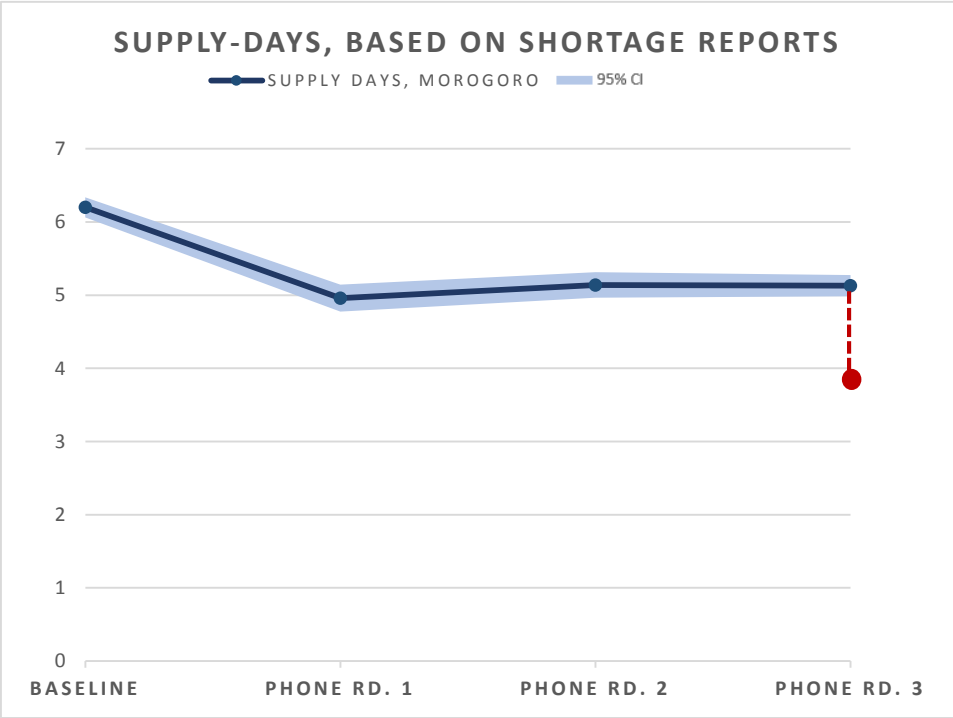
Water supply at the utility level

Demand for connections to network

Access to water and availability of water (household level)

Water quality (source, distribution channel, point of consumption)





Water supply (days/week) from tap connected to public network

Dar es Salaam:
4.2 days
95% CI [3.8,4.6]

Alternate question, Phone Round 3

Morogoro:
3.9 days
95% CI [3.8,4.1]

Alternate question, Phone Round 3

Outcomes

Impact on:

Water supply at the utility level

Demand for connections to network

Access to water and availability of water (household level)

Water quality (source, distribution channel, point of consumption)

System-level

In Dar es Salaam, the Lower Ruvu treatment plant had only one of the four water samples meeting the CDC threshold (0.5 mg/liter).

Outlet Source	6/6/13	6/20/13	7/6/13	7/22/13
Lower Ruvu treatment plant	0.5	0.2	0.4	0.3
Upper Ruvu treatment plant	0.6	1	0.8	1.5
Mtoni treatment plant	0.3	0.8	1.5	3.5

In Morogoro, results were consistent with the fact Mambogo treatment plant is still under construction without full treatment capabilities yet.

Source	4/15/13	4/26/13	5/19/13	6/1/13	6/17/13	7/1/13	7/15/13	7/31/13
Mafiga treatment plant	0.5	0.5	2	4	0.8	0.2	0.8	0.5
Mambogo disinfection point	0.1	0.1	0.3	0.2	4	0.1	0.1	2.5

Chlorine dosing at Mafiga, in Morogoro

Improvements in the water treatment capability especially in Morogoro are likely to provide benefits of improved water quality to city residents.